(12) **UK Patent Application** (19) **GB** (11) **2 318 106** (13) **A**

(43) Date of A Publication 15.04.1998

(21) Application No 9719405.4

(22) Date of Filing 12.09.1997

(30) Priority Data
(31) 19637209. (32) 12.09.1996 (33) DE

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(51) INT CL[6]
F16H 59/60

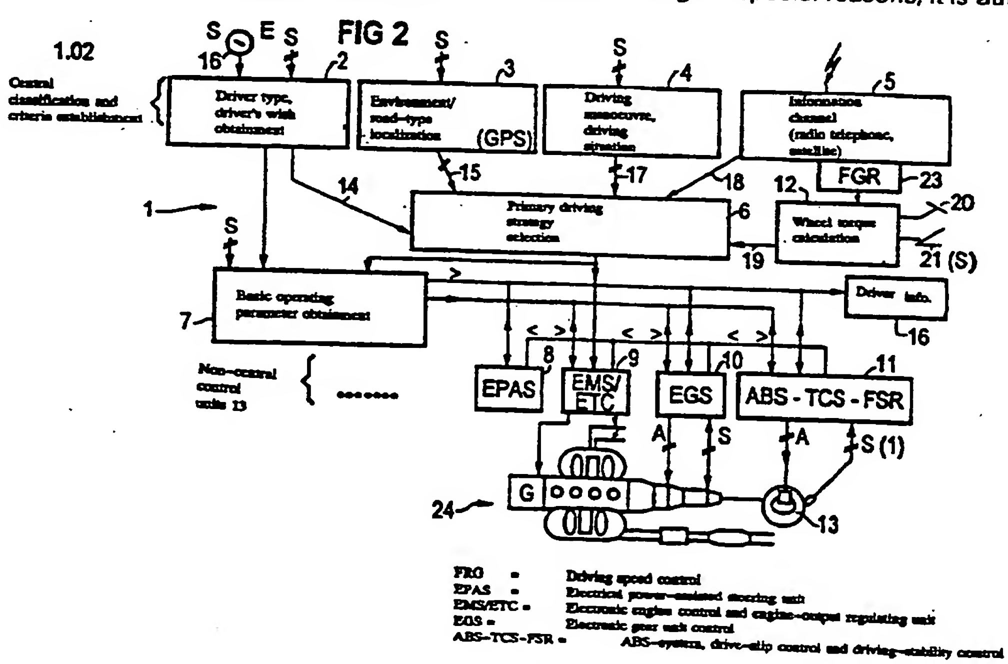
(52) UK CL (Edition P)
B7H HXG H101 H104 H202 H206 H207 H30X H304 H317 H318
F2D DA DA12 DA15 D113 D151 D162 D169 D209 D250

(56) Documents Cited
GB 2240194 A **EP 0766024 A** **EP 0745788 A**
US 5555170 A

(58) Field of Search
UK CL (Edition P) **B7H HXB HXG HXJ , F2D DA DCG**
INT CL[6] **F16H 59/60 59/62 59/64 59/66**
Online: WPI

(54) **Controlling the drive train of a motor vehicle in response to environmental conditions**

(57) In order to control the drive train of a motor vehicle, the position of the accelerator pedal 21 is interpreted as a wheel torque or an initial gear torque that is desired by the driver and together with the position of the brake pedal 20 is used to calculate central control parameters for the drive sources and decelerating units of the drive train. Data on the local environmental load is taken into consideration in such a way that a driving mode of the motor vehicle that is adapted to the respective current environmental conditions is established and indicated to the driver. Unless the driver rejects this mode of driving for special reasons, it is automatically carried out.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

GB 2 318 106 A

FIG 1

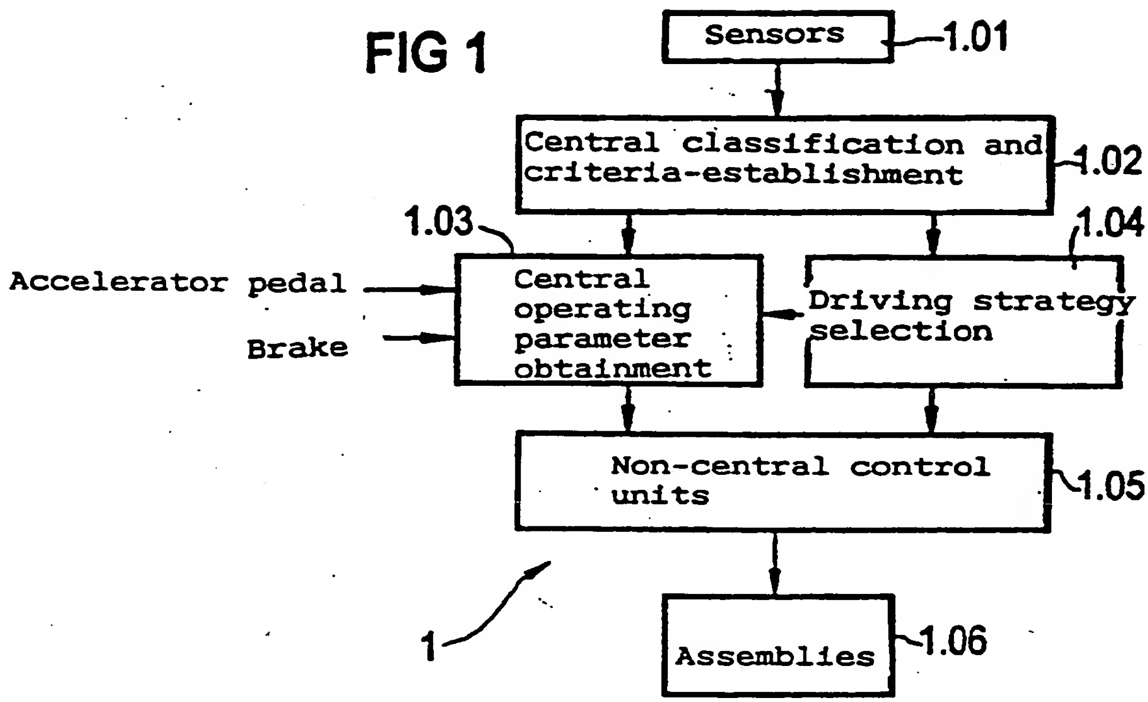

Sensors
1.01
Central classification and criteria-establishment
1.02
1.03
1.04
Accelerator pedal
Brake
Central operating parameter obtainment
Driving strategy selection
Non-central control units
1.05
1
Assemblies
1.06

FIG 3

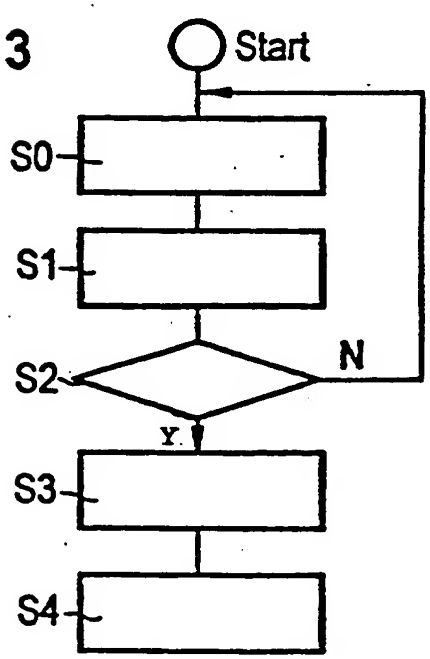
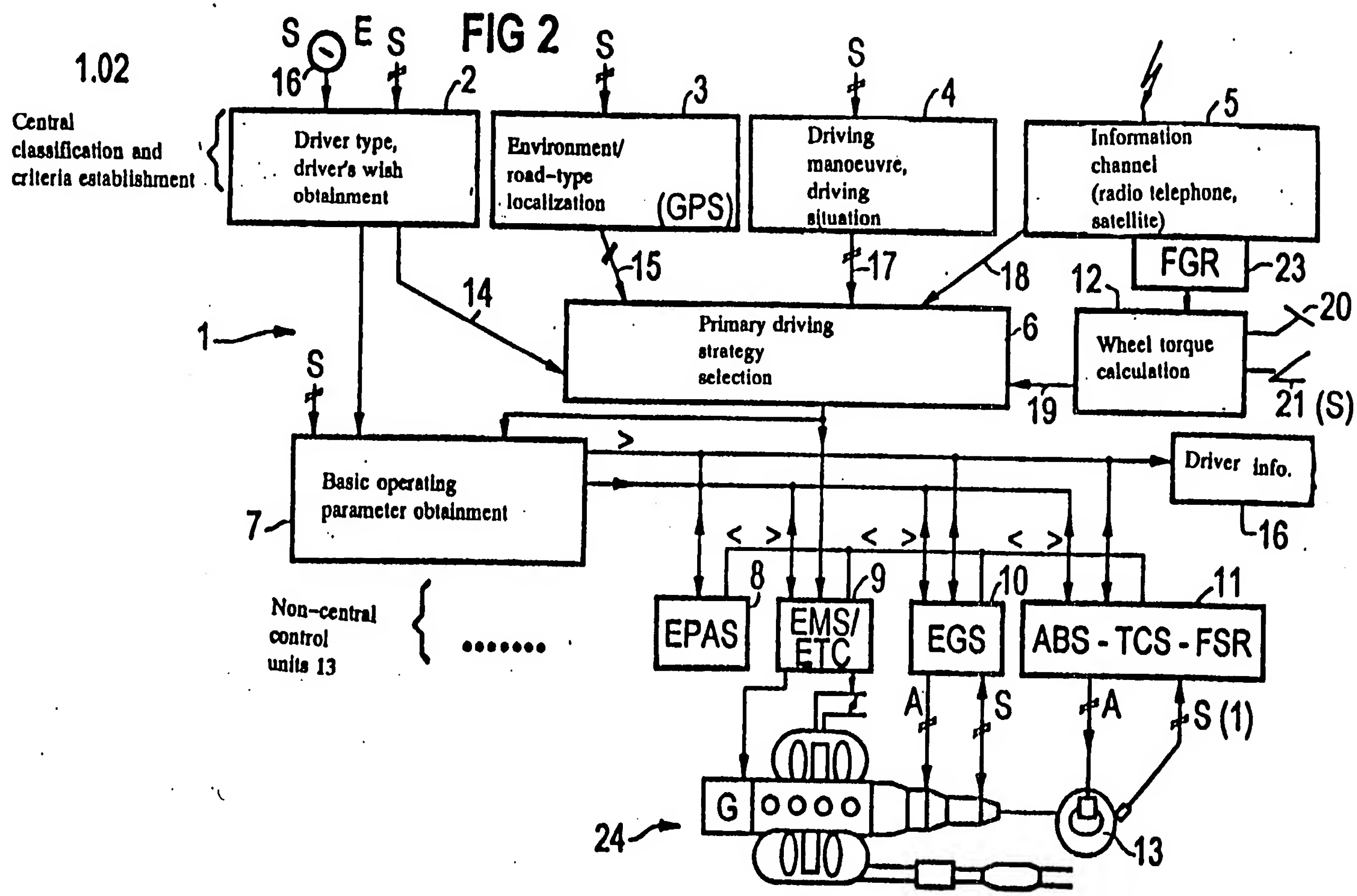

Start
S0
S1
S2
N
Y
S3
S4

FIG 2



FRG = Driving speed control
EPAS = Electrical power-assisted steering unit
EMS/ETC = Electronic engine control and engine-output regulating unit
EGS = Electronic gear unit control
ABS-TCS-FSR = ABS-system, drive-slip control and driving-stability control

METHOD FOR CONTROLLING THE DRIVE TRAIN OF A MOTOR VEHICLE AND INTEGRATED DRIVE TRAIN CONTROL

The invention relates to a method for controlling the drive train of a motor vehicle, and an integrated drive train control.

In known arrangements, the control systems for the engine, the gear unit and the sub-assemblies of a motor vehicle operate largely on their own, that is, the working point and the operating mode of each controlled assembly is set largely independently. Individual component parts of the drive train of a motor vehicle are able to communicate via, for example, a CAN-bus, although these are predominantly used just to exchange sensor data by means of multiplexing. Moreover, the individual control systems influence each other by communicating during certain procedures, for example by reducing the engine torque when changing the transmission ratio of the gear unit, in order to improve the ease of changing gear; by engine drag torque control when braking; and by a braking action or an engine torque reduction when drive slip occurs.

One known proposal for system networking in the automobile aims to achieve an integrated drive train control for a motor vehicle, by means of which drive train control the position of the accelerator pedal is interpreted as a wheel torque or initial gear torque that is desired by the driver and is used to calculate desired values for the engine and for the gear unit of the motor vehicle (F & M Feinwerktechnik Mikrotechnik Messtechnik 101(1993)3, pages 87 to 90). The objective of higher-level optimization of the engine control, electronic accelerator pedal and gear-unit control subsystems that is proposed in that document is to reduce the fuel consumption and to improve the drivability of the motor vehicle, in particular in so far as spontaneous reaction to accelerator pedal

movements is concerned.

Optimization of a drive train (engine, gear unit, differential gear unit, driving wheels) can be effected dynamically during a driving cycle, depending upon the varying drivability criteria (for example sports-style or economical). Generally, the driver always remains the principal decision-maker for the optimization criteria, even in large towns with dense traffic, jam situations and variable ozone concentrations.

Increasingly means of assistance for the driver, for example vehicle-navigation systems having a multi-media character (radio or telephone, for example) and the possibility of receiving information during the journey are being provided in vehicles.

The invention seeks to improve the operation of a motor vehicle by also utilizing information systems which are additionally available during the journey for the control of the drive train. This is important since regulation of the driver in urban traffic seems a possibility for the future because of emission limits which are becoming ever more stringent. The scope for reducing fuel consumption without regulating the driver's behaviour is limited, and in this connection, the emissions (hydrocarbons, nitrogen oxides etc.), in particular in an urban area, are to be reduced as far as possible.

According to one aspect of the present invention, there is provided a method for controlling the drive train of a motor vehicle, comprising the steps of:

calculating central control parameters for drive sources and decelerating units of the drive train from the position of the accelerator pedal and the brake pedal and from data on the local environmental conditions such that a driving mode of the motor vehicle that is adapted to the respective current environmental conditions is established and is

automatically implemented.

According to a second aspect of the present invention, there is provided an integrated drive train control for a motor vehicle which has means for obtaining data on the local environment conditions and a calculating device which produces central control parameters for drive sources and decelerating units of the drive train from the positions of the accelerator pedal and the brake pedal and the from local environment conditions, such that the driving mode of the motor vehicle is adapted to the environmental conditions by means of the central control parameters.

For a better understanding of the present invention, and to show how it may be brought into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 shows a block diagram representing the hierarchical structure or architecture of an integrated drive train control in accordance with one embodiment of the invention;

Figure 2 shows an integrated drive train control, with which the method in accordance with the invention is carried out; and

Figure 3 is a flow chart of the program which is executed by the drive train control according to Figure 2.

An integrated drive train control 1 has the component parts as shown in Figure 1.

The component parts are: sensors 1.01, which have been symbolically combined to form a block; a central classification and criteria-establishing block 1.02; a central operating parameter-obtaining block 1.03 to which signals from the accelerator pedal and the brake pedal of the motor vehicle are fed; a driving strategy selection block 1.04; non-central control units 1.05, combined to form a block; and the assemblies of the

drive train 1.06, for example the engine, the gear unit and the brakes of the motor vehicle, which are to be controlled.

The function and mode of operation of the component parts of Figure 1 are explained in conjunction with the description of the further Figures.

The integrated drive train control 1 is represented in greater detail in Figure 2. It has the following component parts of the central classification and criteria-establishing block 1.02: a driver-type and driver-request obtaining circuit arrangement 2; an environment and road-type localization circuit arrangement 3 (for example by way of a GPS); a driving manoeuvre and driving situation identifying circuit arrangement 4; and an information channel 5 (for example a radio telephone or a satellite receiver). The signals from various sensors in the motor vehicle, which are symbolically denoted by S, are supplied by way of corresponding signal lines to the circuit arrangements 2 to 5 and further circuit component parts of the drive train control 1 (still to be described). The signal lines are indicated in the drawing as multiple lines, yet can also be realized as a data bus (for example a CAN-bus).

A primary driving strategy selection block 6 receives output signals of the circuit arrangements 2 to 5 mentioned above via lines 14 to 18. A wheel torque calculating device 12 receives signals from a brake pedal 20 and an accelerator pedal 21 and provides its output to the primary during strategy selection block 6 through line 19.

Output signals of the primary driving strategy selection block 6 are supplied to a basic operating parameter-obtaining block 7, also called a control circuit arrangement, and an electronic engine control

and engine-output regulating unit 9. Output signals of the basic operating parameter-obtaining block 7 are supplied to: a driver information or display unit 16; an electrical power-assisted steering unit (EPAS) 8; an electronic engine control (EMS/ETC) 9; an electronic gear unit control (EGS) 10; and a brake control 11, which can include an ABS system, a drive-slip control TCS and a driving-stability control FSR.

The basic operating parameter-obtaining block 7 now calculates the central operating parameters of the whole drive train in a coordinated manner in accordance with the stipulations from the driving strategy selection block 6. For example, the transmission ratio and the desired engine torque are determined by block 7, as are the drive type and in the case of a hybrid drive, the individual operating points of the drive. More extensive control of the engine and gear unit than has previously been possible is thus achieved. The engine torque can thus be set as a function of the transmission ratio. This increases the drivability of the motor vehicle, since the driver no longer needs to compensate for a loss of output torque when there is a change up to a higher gear. Moreover, emissions of harmful substances can be reduced in an effective manner, as explained below.

The coordinated determination of the operating parameters occurs not only during a steady state, that is, not only when there is a request for a constant wheel torque from wheel torque calculating device 12, but rather information on dynamic processes, such as cornering or a transition into overrun (vehicle speed is reduced), may be also taken into consideration by the basic operating parameter-obtaining block 7 in order to coordinate the subordinate functional units 8 to 11. Thus during an overrun it is possible not only to keep the current gear ratio, but also at the same

time to activate the fuel cut-off on overrun. When there is extreme cornering, in order to maintain driving stability it is expedient to fix the transmission ratio by means of the gear unit control (EGS) 10 and attenuate load changes in the drive train by means of electronic engine control and engine-output regulating unit (EMS/ETC) 9 or allow them to occur more slowly.

Centralization for the purposes of drivability and emission management is, however, only effected as far as necessary in the form of strategy stipulation. All the other functions (for example functions ensuring that there is driving stability) occur as far as possible within the non-central control units.

The control circuits or gear units 8 to 11 produce actuating signals with which the individual assemblies or component parts of the drive train 24 of the motor vehicle are controlled, that is, the engine by its throttle valve, the gear unit and the brakes of the motor vehicle. The actuating signals are fed by way of lines A from the circuit arrangements 9 to 11 to the assemblies of the drive train, sensor signals S being fed by way of corresponding lines to said circuit arrangements. The control circuit arrangements or gear units 8 to 11 can of course also be assembled as so-called in-situ units together with the respective assembly which is to be controlled or can be integrated therein. Thus it is expedient, for example, to combine the control 11, in particular in the case of an electrical brake actuator, with the brake actuator. The control function is not changed in this way.

The individual component parts of the drive train itself are diagrammatically represented at the bottom of Figure 2; they are not explained here in greater detail, since they are generally known. In a hybrid drive - that is, an internal combustion engine combined

with an electric motor - the engine is coupled with an electric motor and a generator G. Such a hybrid drive is known, for example, from VDI-Report No. 1225, 1995, pages 281-297.

Examples of an overall or combined drive train control according to the invention are:

1. Operation with minimum emissions (HC, NOx):
- The primary driving strategy selection block 6 commits the mode of operation of the whole drive train to minimum harmful substance discharge.
- A central "decision-making unit" in the form of the basic operating parameter-obtaining block 7 accordingly commits the essential operating parameters of circuit arrangements 9, 11 (EMS [electronic engine control], ETC [engine-output regulating unit], EGS [electronic gear unit control]) to a strategy in such a way that the discharge of harmful substances is minimized (for example in urban areas). This stipulation can be translated by the subordinate functional units in the following manner:
  -- ETC (electronic engine-output control): load changes (requested by unit 12) of the internal combustion engine are attenuated (slowed down) or the operating range is limited. By avoiding non-steady state processes, regulations and controls aimed at reducing emissions can then operate faultlessly. Operating ranges having a quantitatively or qualitatively undesirable emission composition are avoided.
  -- EMS (electronic engine control): activation of a mode with low emission levels, for example reduction of the acceleration enrichment in the case of an internal combustion engine, or

changes in the drive type (for example to electric motor, hydrogen drive)

-- EGS (electronic gear unit control): effects, in the case of the internal combustion engine, an operation that is as steady-state as possible in the range with minimum emission levels, for example using CVT or a multi-stage gear unit;

- adaptation of the gearing when the drive type (for example electric motor, hydrogen drive) is changed.

Particularly for this function good cooperation (coordinated by unit 7) between the engine and the gear unit is important, because a plurality of combinations of the resultant engine torque and transmission ratio are possible for a given requested acceleration/speed combination. In addition, it is necessary to coordinate the characteristics of the change of the two manipulated variables over time.

2. Driving performance-orientated mode:
In an operation that is analogous to the operation with minimum emissions, all the non-central functional units are set in such a way that optimum acceleration and rapid response of the drive to a driver-request (unrestricted drive type) which are necessary for sports-style driving or driving uphill, are available.

The architecture of such function sharing can be seen in Figure 1. Of course, decisions of lower control planes, which affect higher-level stipulations, are signalled to the higher control planes if necessary. This will, however, be explained further with reference to Figure 2, the functioning of which will now be explained in detail.

Circuit arrangement 2 is used to obtain information on the type of driver, that is, a classification between driving performance-orientated mode and economical mode. An example of such a function is described in EP 0 576 703 A1. A signal characterising the driver's style of driving is fed to a primary driving strategy selection block 6 by way of a line 14.

Block 3 determines the type of road (town/motorway/country). It may also be provided with additional sensors, for example, to ascertain the general degree of air pollution. If the local position of the vehicle is known with a Global Positioning System (GPS) in conjunction with a digital map (on CD-ROM), this information on the local air pollution can be made available to block 6.

Detection of individual driving manoeuvres, such as, for example, cornering, roadway ascent, drive-brake slip, carried out in block 4, and also information on longitudinal and lateral stability can also be used to determine the driving strategy selection. This information can then also be made available to block 7 in order, by way of a medium-term operating strategy, to achieve a suitable mode of operation of the drive train in the short term as well. It is also possible for the information for blocks 6 and 7 to originate from non-central control units (for example information on stability, with respect to vehicle movement dynamics, from the ABS/TCS/FSR control unit 11 [ABS system, drive-slip control TCS and driving-stability control FSR]) or from the information channel 5. This block 5 makes information available that is given by a central "control system", for example by a traffic-monitoring authority. Thus it is possible to direct a low emission level mode of operation centrally in a region.

The reception of the local environmental data, for example the ozone loading and the local limiting environmental values, which has been transmitted, on the information channel 5, and the reception also of the vehicle coordinates received for example by way of the GPS in the localization circuit arrangement 3, and the evaluation of this data in the primary driving strategy selection block 6 enable the drive train control 1 to regulate the mode of operation as a function of the different maximum limiting values allowed. This is indicated to the driver by way of the driver information unit 16.

If the driver accepts this emission-reducing mode of operation adapted to the environmental load, the regulating and adjusting devices 8, 9, 10 and 11 of the drive train are automatically controlled by means of the primary driving strategy selection block 6 in such a way that the driver's wish is overridden and the motor vehicle is operated with a low emission level in accordance with the local environmental conditions and regulations. The driver can, however, if he considers it necessary, reject the emission-reducing driving mode, for example by actuating a switch, and can choose or maintain another driving strategy. For example, during an overtaking procedure important for safety, he will choose a sports-style driving strategy. In such situations identified by block 4 which are important for safety, and require short-term maximization of the driving power, the driving mode can also be changed (from economical to sports-style).

Moreover, the current vehicle position may be examined for plausibility. The received and processed environmental data and limiting environmental values are then only used for the drive train control if this is expedient. Example: if the motor vehicle is moving within towns or villages, a mode of operation with

minimum emission levels is activated. When driving cross-country, on the other hand, control intervention with reduction of the driving power is not carried out.

The driver, by way of the display 16, receives information on the current environmental values (that is, the hydrocarbons, nitrogen oxides, ozone, carbon monoxide and dioxide, soot particles etc. contained in the ambient air) and on the local limiting environmental values allowed. If suitable sensors are provided in the motor vehicle, the environmental values can also be measured directly in the motor vehicle and be transmitted to the primary driving strategy selection block 6. The steps which occur whilst controlling the drive train in an environment-friendly manner are explained further below with reference to Figure 3.

Block 6 is used to determine the primary driving strategy selection for the subordinate unit 7 which for its part determines the central operating parameters for the non-central control units in a coordinated manner. The information on lines 14, 15, 17 and 18 is compared by means of an established control principle. This is realized by means of a fuzzy system, mathematically formulated algorithms or a neural network.

The sensors S supply necessary signals both for the establishment of the classification and the criteria in the uppermost layer of the drive train control 1, that is, in units 2 - 5, and also for the non-central control units for the individual assemblies. Localization of the sensors with regard to the functional blocks plays a subordinate rôle provided that communication between the sensor signal processing unit in the respective control unit (ECU) and the information source is guaranteed. It is also not important, with regard to the functional architecture,

which functional units are physically present and combined in which ECU. It is thus by all means possible to integrate the driver-type and driver request obtaining circuit arrangement 2 in the gear unit control (EGS) 10, whilst environment and road-type classifications can be accommodated in block 11 (longitudinal and lateral dynamic control).

It is also possible for a central computer to include units 12, 6, 7. The virtual architecture, as represented in Figure 2, is what is essential in order to achieve functioning which is altogether improved. Communication between the physical units, advantageously realized as a form of high-speed serial bus communication (for example by way of a CAN-bus), plays an important rôle thereby.

The stipulations of the driver by means of the accelerator pedal are converted, in block 12, into a desired wheel torque stipulation or a desired initial gear torque, that is, into the torque which is to be transmitted from the driving wheels to the roadway. The influence of environmental influences, such as additional road resistance (uphill drive, loading), is not to be taken into consideration here so as not to alienate the driver from physical reality.

Block 12 is represented separately in Figure 2, yet can also be physically accommodated in the non-central control units 8-11 or 16 (for example EMS-ETC [electronic engine control and engine-output control]). The same applies to blocks 1-7. The signal on line 19 can be output as a wheel torque or an initial gear torque that is desired by the driver or even as a desired circumferential wheel force or desired initial gear torque. It is also possible to stipulate negative desired wheel torques or circumferential forces due to the continuous information provided at the brake pedal 20. Thus, integrated management of driving units (for

example internal combustion engine, electric motor, rotating flywheel) or decelerating units which consume energy (for example service brake, current generator, static flywheel) is possible. As an alternative to the wheel-torque stipulation made by the driver, it is also possible for this to be made by a driving speed regulator or control 23 (FGR).

The information channels between the "basic operating parameter-obtaining" block 7 and the units 9, 10 and 11 can be used in a bidirectional manner. The reason for this is the need, when calculating the basic operating parameters, not only to take into account external conditions, such as driver type, environment and driving manoeuvres, but also to take internal preset operating states of the controlled units in the drive into consideration as well. For example, it is important, after a cold start, to operate the internal combustion engine at increased speeds in order to assist in the heating of the catalytic converter. Moreover, additional load sources (for example an electrically heated catalytic converter) present an additional load on the engine output drive. Delayed adjustment of the ignition after the cold start (possibly an injection of secondary air) for the same purpose changes the characteristics of the drive, something which must be taken into consideration by unit 7 (for example by shifting gear shift points to higher engine speeds).

Similarly, a certain operating state in the gear unit can affect the calculation of the transmission ratio of the gear unit (for example cold gear oil when switching on the converter bypass; in the case of excess temperature of the gear unit, shifting the engine speeds into ranges which increase the volume throughput of the oil pump of the gear unit through the oil cooler is expedient). Other actions affecting the

engine torque, such as, for example, an increase in order to compensate for the torque loss on account of the air-conditioning compressor or efficiency losses of the gear unit (CVT: adjustment of the transmission ratio necessitates greater pumping capacity), take place in the control plane represented by blocks 8-11 provided that they do not need to be assisted by measures in block 7 as well.

In the drive train control according to the invention not only is the gear-changing behaviour when driving uphill and downhill or when there is a driving-performance request related to a driving style and situation subject to criteria that is different from the usual criteria, but so too is the control of the whole drive train including the drive sources.

It can therefore be expedient and necessary in critical situations and during driving manoeuvres to adapt or to keep the current transmission ratio so that it is related to the situation, irrespective of the general strategy which has just been established. Such dynamic corrections are functionally combined with the control of the engine in the control concept according to the invention (one example is keeping in the same gear and activating the engine fuel cutoff on overrun in a coordinated manner).

It is expedient still not to include any parameters which are specific to the engine in block 12 (wheel torque calculation), since after all, for example, in the case of a hybrid drive the choice of drive type is not yet certain on this decision plane. Of course, it is useful to include parameters relating to the conditions, such as traction relationships (winter operation, split subsoil) and ultimately in the case of powerful motorized vehicles, to reduce the sensitivity of the system somewhat preventively (given the same accelerator pedal produce less wheel torque or

initial gear torque). In general, conversion of the accelerator pedal position into a wheel torque or initial gear torque can be effected by means of a fuzzy system which combines the multiple dependencies to give one desired wheel torque or initial gear torque.

The advantages of the invention also lie in integrated wheel torque management which also processes the wheel torque or initial gear torque as a negative value and influences units decelerating both the drive sources and the vehicle. It is particularly simple in this connection to bring about coupling with brake systems with electrical brake application ("brake by wire").

Not only the transmission ratios and the respective desired engine torque, but also the drive type and the individual operating points thereof are established in block 7. In this connection, not only is operation that is strictly wheel torque-orientated possible in accordance with the driver's stipulation, but the real wheel torque or initial gear torque can also be influenced or limited by means of central stipulations relating to the emission of harmful substances. Of course, such actions must be indicated to the driver by block 16 and, as far as possible, take place without restricting drivability.

Blocks 2 to 6, 12 and 16 can be accommodated in independent physical units (control units) or be integrated in units 8-11. This flexibility constitutes a further advantage of the invention.

The data exchange between the individual control units is advantageously effected in a torque-based manner. The following is to be understood by the term "torque-based": if, for example, the gear unit requests an engine torque reduction, it transmits to the engine control a variable which represents the desired torque, that is, the desired engine torque, and does not

demand, for example, a reduction of the ignition angle by 5%. Conversely, in order to determine the engine torque at the current working point for example, the throttle valve position and the engine speed, from which the gear-unit control could determine the current engine torque by way of a matrix stored in the gear-unit control, are not transmitted to the gear-unit control, but instead the engine control transmits the current engine torque to the gear-unit control by way of an interface (for example, a CAN bus).

A flow chart, which is worked through by the drive train control 1 according to the invention, can be seen in Figure 3. After the **start** the program carries out the following steps **S0** to **S4**:

S0 Reception and processing of the local environmental data and local limiting environmental values or on-line measurement of the environmental data in the vehicle

S1 Reception and processing of the navigational data for determining the position of the vehicle

S2 Interrogation as to whether the received and processed environmental data and limiting environmental values, in view of the current position of the vehicle, make control intervention (by means of the primary driving strategy selection block 6) seem expedient: if this is not the case, there is a return to the start; if intervention is expedient, the procedure continues with

S3 Indication of the current environmental data and limiting environmental values on a driver information system (display 16)

S4 Unless there is rejection by the driver: transmission of the environmental data and limiting values to the controller and regulator regulating the drive train (7, 9, 10 and, if

applicable 8, 11).

With that the program run is at an end. It is executed anew at respective given intervals or cyclically.

It is particularly advantageous that, on the one hand, the mode of operation of the motor vehicle adapted to the respective current environmental conditions is continuously determined and indicated to the driver. Unless the driver rejects this driving mode for special reasons, on the other hand, the driving mode that is adapted to the current environmental conditions is carried out automatically.

CLAIMS

1. A method for controlling the drive train of a motor vehicle, comprising the steps of:

calculating central control parameters for drive sources and decelerating units of the drive train from the position of the accelerator pedal and the brake pedal and from data on the local environmental conditions such that a driving mode of the motor vehicle that is adapted to the respective current environmental conditions is established and is automatically implemented.

2. A method as claimed in claim 1, wherein the position of the accelerator pedal is interpreted as a wheel torque or an initial gear torque that is desired by the driver and is used to calculate desired values for the engine and the gear unit of the motor vehicle.

3. A method as claimed in claim 1 or 2, wherein the established driving mode is indicated to the driver.

4. A method as claimed in any preceding claim, wherein the data on the local environmental conditions is received by radio from a device in the motor vehicle that is responsible for determining or relaying such data and is made available in an information channel.

5. A method as claimed in any preceding claim, wherein the data on the local environmental conditions is measured in the motor vehicle and made available in an information channel.

6. A method as claimed in any preceding claim, wherein respective locally prescribed limiting environmental values are taken into consideration when controlling the drive train.

7. A method as claimed in any preceding claim, wherein sensor signals from the drive train are evaluated and operating parameters of the motor vehicle classified in a classification device.

8. A method as claimed in any preceding claim, further comprising the steps of examining, with regard to the current position of the vehicle, whether control intervention is expedient with the environmental data which has been received and processed and whether safety is unimpaired, wherein intervention is only carried out in that case.

9. A method for controlling a drive train of a motor vehicle substantially as herein described with reference to the accompanying drawings.

10. An integrated drive train control for a motor vehicle which has means for obtaining data on the local environment conditions and a calculating device which produces central control parameters for drive sources and decelerating units of the drive train from the positions of the accelerator pedal and the brake pedal and the from local environment conditions, such that the driving mode of the motor vehicle is adapted to the environmental conditions by means of the central control parameters.

11. An integrated drive train control as claimed in claim 10, wherein the means for obtaining data on the local environment conditions comprises an information channel in which data on the local environmental load is made available.

12. A drive train control according to claim 11, wherein a driving strategy is selected in a selection circuit arrangement with the aid of output signals of the classification circuit arrangement and of the information channel, coordinated calculation of the central operating parameters of the drive train is carried out in a control circuit arrangement in accordance with the selected driving strategy, output signals of the calculating device and the selection circuit arrangement are received in non-central control units, and control signals produced for the engine, the

gear unit and the brake system of the motor vehicle.

13. A drive train control according to claim 11 or 12, wherein the data on the local environmental conditions is received by radio from a device in the motor vehicle that is responsible for determining or relaying such data and is made available in an information channel.

14. A drive train control substantially as herein described with reference to the accompanying drawings.

15. A motor vehicle having a drive train control operating in accordance with the method as claimed in one of claims 1-9, or as claimed in one of claims 10-14.

The Patent Office

Application No: GB 9719405.4
Claims searched: 1 - 13

Examiner: Tom Sutherland
Date of search: 2 February 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B7H (HXH, HXB, HXJ); F2D (DA, DCG)

Int Cl (Ed.6): F16H 59/60, 59/62, 59/64, 59/66

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2240194 A	(NISSAN) Note page 11 line 12 to page 13 line 5.	1, 5, 10
X, P	EP 0766024 A	(BMW) The Fig.	1, 4 - 7, 10, 11
X, P	EP 0745788 A	(AISIN AW) Note Figs 2to 4.	1, 4, 10
X	US 5555170	(MITSUBISHI) see Figs 1 and 2.	1, 5, 7, 10

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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